![A close up of a sign

Description automatically generated]()

A picture containing sitting, screen, dark, light

Description automatically generated

Implementing Cisco SD-WAN Solutions (300-415)

*Memory Exercises Created by Luke Snell*

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| Document Information | |
| **Document Title** | Implementing Cisco SD-WAN Solutions (300-415): Memory Exercises |
| **Brief Description** | A document to assist persons studying for the CCNP Enterprise specialist exam “Implementing Cisco SD-WAN Solutions (300-415)” |
| **Create Date** | 30.08.20 |
| **Author** | Luke Snell |
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| **Date** | **Version** | **Revised by** | **Revision Notes** |
| XX.XX.XX | 1.0 | Luke Snell | Initial Public Release |

**How to Use this Document**

This document has been created for persons preparing to sit the CCNP Enterprise specialist exam “*Implementing Cisco SD-WAN Solutions (300-415)*”. It contains a variety of “memory exercises” for topics listed on the examination blueprint that have been derived from materials I used while preparing for the exam.

The best way to utilise this document is to scan through it to identify topics whose information you are not confident with recalling under exam conditions. Once you have identified your strengths and weaknesses then proceed to printing off a suitable number of each exercise to complete. Your weakest topics should have more exercises to complete so that you do not waste time revising topics you are already comfortable with. From an organisational perspective, try to use the concept of [spaced repetition](https://www.youtube.com/watch?v=cVf38y07cfk) to maximise your revision schedule.

No memory exercises contain command syntax or configuration processes. Familiarity with CLI syntax, APIs, and the vManage GUI should all come from labbing topics.

Finally, please note that this is one of *many* resources you should utilise when preparing for the certification exam. Using this resource does not guarantee that you will pass the exam – it’s just here to help you further sharpen your skills before entering the exam environment and to reduce the probability of “surrendering easy points” in the 50 or so questions that will be thrown at you.

Best of luck with your journey!

* Luke Snell

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# Colours & Public/Private IPs

**Private Colours:** used where no NAT addressing of transport IP endpoints occurs

|  |  |  |
| --- | --- | --- |
| metro-ethernet | mpls | private1 – private6 |

**Public Colours:** used where NAT addressing of transport IP endpoints occurs

|  |  |  |  |
| --- | --- | --- | --- |
| 3g | biz-internet | lte | public-internet |

**Private IP:** Any IP address assigned to interface, pre-NAT address

**Public IP:** Same as “private IP” if no NAT, else it’s post-NAT adder

|  |  |  |  |
| --- | --- | --- | --- |
| **Source Colour Type** | **Destination Colour Type** | **IPs used…** | |
| Public | Public | **Public** | Private |
| Public | Private | **Public** | Private |
| Private | Private | Public | **Private** |

**Private Colours:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Public Colours:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Public IP:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Private IP:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |
| --- | --- | --- | --- |
| **Source Colour Type** | **Destination Colour Type** | **IPs used…** | |
| Public | Public | Public | Private |
| Public | Private | Public | Private |
| Private | Private | Public | Private |

# NAT Types

|  |  |
| --- | --- |
| **Type** | **Comment** |
| Full Cone / One-to-One NAT | Maps internal address/port pair to external address/port pair. |
| Address-Restricted Cone NAT  [Restricted Cone NAT] | Permits outbound connections inwards IF-AND-ONLY-IF a session was established from the inside first. |
| Port Restricted Cone NAT | Stricter version of Restricted Cone NAT where ports are added to process. |
| Symmetric NAT | Unique external IP/port mapping created for each destination IP/port.  Outbound connections permitted inwards only if inside network initiated stream.  Only supported on one end of the tunnel and with One-to-One NAT. |

|  |  |  |  |
| --- | --- | --- | --- |
| **wEdge A** | **wEdge B** | **IPSec Tunnel Formed?** | |
| Public IP [No Nat] | Public IP [No Nat] | Yes | No |
| Full Cone | Full Cone | Yes | No |
| Full Cone | Address/Port Restricted NAT | Yes | No |
| Address/Port Restricted NAT | Address/Port Restricted NAT | Yes | No |
| Public | Symmetric | Yes | No |
| Full Cone | Symmetric | Yes | No |
| Symmetric | Address/Port Restricted NAT | Yes | No |
| Symmetric | Symmetric | Yes | No |

|  |  |
| --- | --- |
| **Type** | **Comment** |
| Full Cone / One-to-One NAT |  |
| Address-Restricted Cone NAT  [Restricted Cone NAT] |  |
| Port Restricted Cone NAT |  |
| Symmetric NAT | •  •  • |

|  |  |  |  |
| --- | --- | --- | --- |
| **wEdge A** | **wEdge B** | **IPSec Tunnel Formed?** | |
| Public IP [No Nat] | Public IP [No Nat] | Yes | No |
| Full Cone | Full Cone | Yes | No |
| Full Cone | Address/Port Restricted NAT | Yes | No |
| Address/Port Restricted NAT | Address/Port Restricted NAT | Yes | No |
| Public | Symmetric | Yes | No |
| Full Cone | Symmetric | Yes | No |
| Symmetric | Address/Port Restricted NAT | Yes | No |
| Symmetric | Symmetric | Yes | No |

# OMP Route Table Abbreviations

|  |  |
| --- | --- |
| **Symbol** | **Meaning** |
| C | Chosen |
| I | Installed |
| Red | Redistributed |
| Rej | Rejected |
| L | Looped |
| R | Resolved |
| S | Stale |
| Ext | Extranet |
| Inv | Invalid |
| Stg | Staged |
| U | TLOC Unresolved |

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Meaning** | **Symbol** | **Meaning** |
| C |  | U |  |
| I |  | Stg |  |
| Red |  | Inv |  |
| Rej |  | Ext |  |
| L |  | S |  |
| R |  | R |  |
| S |  | L |  |
| Ext |  | Rej |  |
| Inv |  | Red |  |
| Stg |  | I |  |
| U |  | C |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Meaning** | **Symbol** | **Meaning** |
| C |  | U |  |
| I |  | Stg |  |
| Red |  | Inv |  |
| Rej |  | Ext |  |
| L |  | S |  |
| R |  | R |  |
| S |  | L |  |
| Ext |  | Rej |  |
| Inv |  | Red |  |
| Stg |  | I |  |
| U |  | C |  |

# Policy Types

|  |  |
| --- | --- |
| **Central Control** | **Central Data** |
| Control | Traffic Data |
| VPN Membership | Application Aware Routing |
|  | Cflowd |

|  |  |
| --- | --- |
| **Traditional Localised Policy** | **Security Policy** |
| Route Policy | Firewall |
| QoS | Intrusion Prevention |
| ACLs | URL Filtering |
|  | AMP |
|  | DNS Security |

|  |  |
| --- | --- |
| **Central Control** | **Central Data** |
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| --- | --- |
| **Traditional Localised Policy** | **Security Policy** |
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| --- | --- |
| **Central Control** | **Central Data** |
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|  |  |
| --- | --- |
| **Traditional Localised Policy** | **Security Policy** |
|  |  |
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|  |  |
| --- | --- |
| **Central Control** | **Central Data** |
|  |  |
|  |  |
|  |  |

# Policy Lists

|  |  |
| --- | --- |
| **Name** | **Purpose** |
| Application | Match on an application / app family |
| Colour | Specify a single colour or colour group |
| Prefix | Match routing info in control plane specifically |
| Data Prefix | Match data in the data plane specifically |
| Site | Matching criteria to determine where policy application occurs |
| Policers | Limit ingress/egress traffic, cannot match off |
| SLA Class | Defines loss, latency and jitter that a class of traffic experience |
| TLOC | Used to manipulate next-hop of traffic forwarded |
| VPN | Service-side VPNs for which data policy should be applied to |

|  |  |
| --- | --- |
| **Name** | **Purpose** |
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|  |  |
| --- | --- |
| **Name** | **Purpose** |
|  |  |
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# Policy Application & Enforcement

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Applied To…** | | **Enforced On…** | |
| Data Policy | vSmart | wEdge | vSmart | wEdge |
| App-Aware Routing Policy | vSmart | wEdge | vSmart | wEdge |
| Control Policy | vSmart | wEdge | vSmart | wEdge |
| VPN Membership Policy | vSmart | wEdge | vSmart | wEdge |
| Localized Policy | vSmart | wEdge | vSmart | **wEdge** |
| Security Policy | vSmart | wEdge | vSmart | **wEdge** |
| cFlowd | vSmart | wEdge | vSmart | **wEdge** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Applied To…** | | **Enforced On…** | |
| Data Policy | vSmart | wEdge | vSmart | wEdge |
| App-Aware Routing Policy | vSmart | wEdge | vSmart | wEdge |
| Control Policy | vSmart | wEdge | vSmart | wEdge |
| VPN Membership Policy | vSmart | wEdge | vSmart | wEdge |
| Localized Policy | vSmart | wEdge | vSmart | wEdge |
| Security Policy | vSmart | wEdge | vSmart | wEdge |
| cFlowd | vSmart | wEdge | vSmart | wEdge |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Applied To…** | | **Enforced On…** | |
| Data Policy | vSmart | wEdge | vSmart | wEdge |
| App-Aware Routing Policy | vSmart | wEdge | vSmart | wEdge |
| Control Policy | vSmart | wEdge | vSmart | wEdge |
| VPN Membership Policy | vSmart | wEdge | vSmart | wEdge |
| Localized Policy | vSmart | wEdge | vSmart | wEdge |
| Security Policy | vSmart | wEdge | vSmart | wEdge |
| cFlowd | vSmart | wEdge | vSmart | wEdge |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Applied To…** | | **Enforced On…** | |
| Data Policy | vSmart | wEdge | vSmart | wEdge |
| App-Aware Routing Policy | vSmart | wEdge | vSmart | wEdge |
| Control Policy | vSmart | wEdge | vSmart | wEdge |
| VPN Membership Policy | vSmart | wEdge | vSmart | wEdge |
| Localized Policy | vSmart | wEdge | vSmart | wEdge |
| Security Policy | vSmart | wEdge | vSmart | wEdge |
| cFlowd | vSmart | wEdge | vSmart | wEdge |

# Packet Forwarding Order of Operations

|  |  |
| --- | --- |
| **Step** | **Operation** |
| 1 | IP Destination Lookup |
| 2 | Ingress Interface ACL  *If denied then drop packet* |
| 3 | Application-Aware Routing  *Requires equal cost multipath (ECMP) routes in routing table* |
| 4 | Centralized Data Policy  *Can override Step 3 decision* |
| 5 | Routing and Forwarding |
| 6 | Security Policy  *Firewall > Intrusion Prevention > URL-Filtering > AMP* |
| 7 | Encapsulation and Encryption |
| 8 | Egress Interface ACLs  *Changes occur prior to packet forwarding* |

|  |  |
| --- | --- |
| **Step** | **Operation** |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |
| 7 |  |
| 8 |  |

|  |  |
| --- | --- |
| **Step** | **Operation** |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |
| 7 |  |
| 8 |  |